

## CLAIMS

What is claimed is:

1        1. A method for processing an input signal for application to an amplifier to generate an amplified  
2        output signal, comprising:

3            generating an index into a look-up table based on the input signal;

4            adjusting the index to compensate for changes in operating characteristics of the amplifier over time;

5            retrieving one or more pre-distortion parameters from the look-up table based on the adjusted index;

6        and

7            pre-distorting the input signal based on the one or more pre-distortion parameters to generate a pre-  
8        distorted input signal for application to the amplifier.

1        2. The invention of claim 1, wherein the index is adjusted based on a measure of distortion in the  
2        amplified output signal.

1        3. The invention of claim 2, wherein the measure of distortion is based on a narrow-band power  
2        level in the amplified output signal.

1        4. The invention of claim 1, further comprising amplifying the pre-distorted input signal with the  
2        amplifier to generate the amplified output signal.

1        5. The invention of claim 4, wherein amplifying the pre-distorted input signal comprises controlling  
2        overall gain of the amplifier to compensate for the changes in the operating characteristics of the  
3        amplifier.

1        6. The invention of claim 5, wherein the overall gain is controlled based on a comparison of power  
2        of the pre-distorted input signal and power of the amplified output signal.

1        7. The invention of claim 5, wherein the overall gain is controlled to keep the overall gain  
2        substantially constant over time.

1        8. The invention of claim 7, wherein the overall gain is further controlled to reduce distortion in the  
2        amplified output signal.

1        9. The invention of claim 5, wherein the overall gain is controlled to reduce distortion in the  
2        amplified output signal.

1        10. The invention of claim 5, wherein amplifying the pre-distorted input signal further comprises  
2        controlling bias applied to one or more amplifier stages of the amplifier.

1        11. The invention of claim 10, wherein the bias is controlled based on a measure of distortion in the  
2        amplified output signal.

1        12. The invention of claim 11, wherein the measure of distortion is based on a narrow-band power  
2        level in the amplified output signal.

1        13. The invention of claim 4, wherein amplifying the pre-distorted input signal comprises controlling  
2        bias applied to one or more amplifier stages of the amplifier.

1        14. The invention of claim 13, wherein the bias is controlled based on a measure of distortion in the  
2        amplified output signal.

1        15. The invention of claim 14, wherein the measure of distortion is based on a narrow-band power  
2        level in the amplified output signal.

1        16. The invention of claim 1, wherein the look-up table corresponds to frequency-independent pre-  
2        distortion processing.

1        17. The invention of claim 1, wherein the look-up table corresponds to frequency-dependent pre-  
2        distortion processing.

1        18. The invention of claim 1, further comprising:  
2            retrieving one or more other pre-distortion parameters from a different look-up table based on the  
3            input signal; and  
4            pre-distorting the input signal based on the one or more other pre-distortion parameters to generate a  
5            different pre-distortion component for the pre-distorted input signal, wherein the different look-up table  
6            is automatically updated by:  
7            generating a measure based on current operations of the amplifier;

8                   applying the measure to one or more algebraic equations to generate one or more parameter  
9                   values; and

10                  applying the one or more parameter values to one or more polynomials to update the different  
11                  look-up table.

1                  19. The invention of claim 1, wherein the look-up table is automatically updated by:  
2                   generating a measure based on current operations of the amplifier;  
3                   applying the measure to one or more algebraic equations to generate one or more parameter values;  
4                   and  
5                   applying the one or more parameter values to one or more polynomials to update the look-up table.

1                  20. The invention of claim 1, wherein the look-up table is generated during training of the amplifier  
2                  and always kept fixed after training is complete.

1                  21. The invention of claim 1, wherein the index is based on power of the input signal.

1                  22. Apparatus for processing an input signal for application to an amplifier to generate an amplified  
2                  output signal, comprising:  
3                   an index generator adapted to generate an index into a look-up table based on the input signal;  
4                   an index adjuster adapted to adjust the index to compensate for changes in operating characteristics  
5                  of the amplifier over time;  
6                   the look-up table adapted to provide one or more pre-distortion parameters based on the adjusted  
7                  index; and  
8                   a pre-distorter adapted to pre-distort the input signal based on the one or more pre-distortion  
9                  parameters to generate a pre-distorted input signal for application to the amplifier.

1                  23. The invention of claim 22, wherein the index adjuster is adapted to adjust the index based on a  
2                  measure of distortion in the amplified output signal.

1                  24. The invention of claim 23, wherein the measure of distortion is based on a narrow-band power  
2                  level in the amplified output signal.

1                  25. The invention of claim 22, further comprising the amplifier adapted to amplify the pre-distorted  
2                  input signal to generate the amplified output signal.

1        26. The invention of claim 25, wherein the amplifier is adapted to control overall gain of the  
2        amplifier to compensate for the changes in the operating characteristics of the amplifier.

1        27. The invention of claim 26, wherein the amplifier is adapted to control the overall gain based on a  
2        comparison of power of the pre-distorted input signal and power of the amplified output signal.

1        28. The invention of claim 26, wherein the amplifier is adapted to control the overall gain to keep the  
2        overall gain substantially constant over time.

1        29. The invention of claim 28, wherein the overall gain is further controlled to reduce distortion in  
2        the amplified output signal.

1        30. The invention of claim 26, wherein the overall gain is controlled to reduce distortion in the  
2        amplified output signal.

1        31. The invention of claim 26, wherein the amplifier is further adapted to control bias applied to one  
2        or more amplifier stages of the amplifier.

1        32. The invention of claim 31, wherein the amplifier is adapted to control the bias based on a  
2        measure of distortion in the amplified output signal.

1        33. The invention of claim 32, wherein the measure of distortion is based on a narrow-band power  
2        level in the amplified output signal.

1        34. The invention of claim 25, wherein the amplifier is adapted to control bias applied to one or more  
2        amplifier stages of the amplifier.

1        35. The invention of claim 34, wherein the amplifier is adapted to control the bias based on a  
2        measure of distortion in the amplified output signal.

1        36. The invention of claim 35, wherein the measure of distortion is based on a narrow-band power  
2        level in the amplified output signal.

1       37. The invention of claim 25, further comprising:  
2       a first power detector adapted to detect power of the pre-distorted input signal;  
3       a second power detector adapted to detect power of the amplified output signal;  
4       a receiver adapted to detect narrow-band power of the amplified output signal at a selected  
5       frequency; and  
6       a controller adapted to process the detected powers from the first and second power detectors and  
7       from the receiver to generate one or more control signals used to control operations within the apparatus.

1       38. The invention of claim 37, wherein the one or more control signals control the index adjuster, a  
2       variable attenuator in the amplifier, and bias levels applied to one or more amplifier stages in the  
3       amplifier.

1       39. The invention of claim 37, wherein the first and second power detectors are wide-band power  
2       detectors.

1       40. The invention of claim 37, wherein the controller is adapted to change the selection of the  
2       frequency of the receiver.

1       41. The invention of claim 22, wherein the look-up table corresponds to frequency-independent pre-  
2       distortion processing.

1       42. The invention of claim 22, wherein the look-up table corresponds to frequency-dependent pre-  
2       distortion processing.

1       43. The invention of claim 22, further comprising:  
2       a different look-up table adapted to provide one or more other pre-distortion parameters based on the  
3       input signal, wherein the pre-distorter is further adapted to pre-distort the input signal based on the one or  
4       more other pre-distortion parameters to generate a different pre-distortion component for the pre-  
5       distorted input signal; and  
6       a controller adapted to automatically update the different look-up table by:  
7       generating a measure based on current operations of the amplifier;  
8       applying the measure to one or more algebraic equations to generate one or more parameter  
9       values; and

10 applying the one or more parameter values to one or more polynomials to update the different  
11 look-up table.

1 44. The invention of claim 22, further comprising a controller adapted to automatically update the  
2 look-up table by:

3 generating a measure based on current operations of the amplifier;

4 applying the measure to one or more algebraic equations to generate one or more parameter values;  
5 and

6 applying the one or more parameter values to one or more polynomials to update the look-up table.

1 45. The invention of claim 22, wherein the look-up table is generated during training of the amplifier  
2 and always kept fixed after training is complete.

1 46. The invention of claim 22, wherein the index is based on power of the input signal.

1 47. A method for processing an input signal for application to an amplifier to generate an amplified  
2 output signal, comprising:

3 retrieving one or more pre-distortion parameters from a look-up table based on the input signal; and  
4 pre-distorting the input signal based on the one or more pre-distortion parameters to generate a pre-  
5 distorted input signal for application to the amplifier, wherein the look-up table is automatically updated  
6 by:

7 generating a measure based on current operations of the amplifier;

8 applying the measure to one or more algebraic equations to generate one or more parameter  
9 values; and

10 applying the one or more parameter values to one or more polynomials to update the look-up  
11 table.

1 48. The invention of claim 47, wherein the measure is average power of the input signal.

1 49. The invention of claim 47, wherein each algebraic equation is a piecewise linear curve.

1 50. The invention of claim 47, wherein:

2 the measure is applied to four algebraic equations to generate four parameter values; and

3        the four parameter values are applied to two second-order polynomials to update two pre-distortion  
4        parameters in the look-up table.

1        51. The invention of claim 47, wherein the pre-distortion parameters are frequency-dependent pre-  
2        distortion parameters.

1        52. The invention of claim 47, wherein the pre-distortion parameters are frequency-independent pre-  
2        distortion parameters.

1        53. The invention of claim 47, wherein the look-up table is updated at a specified periodic rate.

1        54. The invention of claim 47, wherein the look-up table is updated based on a detected change in  
2        operating conditions of the amplifier.

1        55. The invention of claim 54, wherein the detected change in the amplifier operating conditions  
2        corresponds to a change in a parameter value greater than a specified threshold value.

1        56. The invention of claim 47, wherein the one or more parameter values are fine-tuned based on  
2        output spectrum of the amplifier.

1        57. Apparatus for processing an input signal for application to an amplifier to generate an amplified  
2        output signal, comprising:

3            a look-up table adapted to provide one or more pre-distortion parameters based on the input signal;  
4            a pre-distorter adapted to pre-distort the input signal based on the one or more pre-distortion  
5        parameters to generate a pre-distorted input signal for application to the amplifier; and

6            a controller adapted to automatically update the look-up table by:

7                generating a measure based on current operations of the amplifier;

8                applying the measure to one or more algebraic equations to generate one or more parameter  
9        values; and

10                applying the one or more parameter values to one or more polynomials to update the look-up  
11        table.

1        58. The invention of claim 57, wherein:

2        the measure is average power of the input signal; and

3        further comprising an envelope detector adapted to detect current power of the input signal, wherein  
4        the controller uses the current input signal power to generate the average input signal power.

1        59. The invention of claim 57, wherein each algebraic equation is a piecewise linear curve.

1        60. The invention of claim 57, wherein:

2        the controller is adapted to apply the measure to four algebraic equations to generate four parameter  
3        values; and

4        the controller is adapted to apply the four parameter values to two second-order polynomials to  
5        update two pre-distortion parameters in the look-up table.

1        61. The invention of claim 57, wherein the pre-distortion parameters are frequency-dependent pre-  
2        distortion parameters.

1        62. The invention of claim 57, wherein the pre-distortion parameters are frequency-independent pre-  
2        distortion parameters.

1        63. The invention of claim 57, wherein the controller is adapted to update the look-up table at a  
2        specified periodic rate.

1        64. The invention of claim 57, wherein the controller is adapted to update the look-up table based on  
2        a detected change in operating conditions of the amplifier.

1        65. The invention of claim 64, wherein the detected change in the amplifier operating conditions  
2        corresponds to a change in a parameter value greater than a specified threshold value.

1        66. The invention of claim 57, wherein the controller is adapted to fine-tune the one or more  
2        parameter values based on output spectrum of the amplifier.